Section 3.5

Derivatives of Trigonometric Functions

Find the derivative of $y = \sin x$

$$\frac{d}{dx} \sin x = \cos x$$

Find the derivative of $y = \cos x$

$$\frac{d}{dx} \cos x = - \sin x$$

Find the derivative of $y = x^2 \sin x$

Find the derivative of $y = \dfrac{\cos x}{(1 - \sin x)}$

Find the derivative of tan x

$$y = \frac{\sin x}{\cos x}$$

$$y' = \frac{(\cos x)(\cos x) - (\sin x)(-\sin x)}{\cos^2 x}$$

$$= \frac{\cos^2 x + \sin^2 x}{\cos^2 x}$$

$$= \frac{1}{\cos^2 x} = \sec^2 x$$

$$\frac{d}{dx} \tan x = \sec^2 x$$

Find the derivative of cot x

$$\cot x = \frac{\cos x}{\sin x}$$

$$y' = \frac{(-\sin x)(\sin x) - (\cos x)(\cos x)}{\sin^2 x}$$

$$= \frac{-\sin^2 x - \cos^2 x}{\sin^2 x} = \frac{-1(\sin^2 x + \cos^2 x)}{\sin^2 x}$$

$$= \frac{-1}{\sin^2 x} = -\csc^2 x$$

$$\frac{d}{dx} \cot x = - \csc^2 x$$

Find the derivative of sec x

$$\sec x = \frac{1}{\cos x}$$

$$y' = \frac{(0)(\cos x) - (1)(-\sin x)}{\cos^2 x}$$

$$= \frac{\sin x}{\cos^2 x}$$

$$= \frac{\sin x}{\cos x} \cdot \frac{1}{\cos x}$$

$$= \tan x \sec x$$

$$\frac{d}{dx} \sec x = \sec x \tan x$$

Find the derivative of csc x

$$\csc x = \frac{1}{\sin x}$$

$$y' = \frac{(0)(\sin x) - (1)(\cos x)}{\sin^2 x}$$

$$y' = \frac{-\cos x}{\sin^2 x}$$

$$= -\frac{\cos x}{\sin x} \cdot \frac{1}{\sin x}$$

$$= -\cot x \csc x$$

$$\frac{d}{dx} \csc x = -\csc x \cot x$$

Find the derivative of 2 cos x - 3 tan x

$$y' = -2\sin x - 3\sec^2 x$$

Find the derivative of $x^2 + \sin x$

$$y' = 2x + \cos x$$

Find the derivative of $\tan x - \frac{2}{x}$

$$y' = \sec^2 x + \frac{2}{x^2}$$

$\frac{-2}{x} = -2x^{-1}$

$= 2x^{-2}$

Find the derivative of cos x tan x

$= \cancel{\cos x \frac{\sin x}{\cos x}}$

$= \sin x$

$$y' = -\sin x \tan x + \cos x \sec^2 x$$

$$= -\sin x \cdot \frac{\sin x}{\cos x} + \cos x \cdot \frac{1}{\cos^2 x}$$

$$= \frac{-\sin^2 x}{\cos x} + \frac{1}{\cos x}$$

$$= \frac{1 - \sin^2 x}{\cos x}$$

$$= \frac{\cos^2 x}{\cos x} = \cos x$$

Find the derivative of $\frac{x^2}{\sin x}$

$$y' = \frac{(2x)(\sin x) - (x^2)(\cos x)}{\sin^2 x} \leftarrow$$

$$= \frac{2x \sin x}{\sin^2 x} - \frac{x^2 \cos x}{\sin^2 x}$$

$$= \frac{2x}{\sin x} - \frac{x^2 \cos x}{\sin^2 x} = 2x \csc x - x^2 \cot x \csc x$$

$$= x \csc x (2 - x \cot x)$$

Find the derivative of $\sqrt{x}\sec x$

$= x^{\frac{1}{2}}\sec x$

$$y' = \frac{1}{2}x^{-\frac{1}{2}}(\sec x) + \sqrt{x}(\sec x)(\tan x)$$

$$= \frac{\sec x}{2\sqrt{x}} + \sqrt{x}\sec x\tan x$$

Find the derivative of 4 cot x tan x

$$y = 4 \cdot \frac{\cos x}{\sin x} \cdot \frac{\sin x}{\cos x}$$

$$y = 4$$

$$y' = 0$$

Find the derivative of 2x sin x - csc x

$$y' = (2)(\sin x) + (2x)(\cos x) + \csc x \cot x$$

Find the derivative of $\dfrac{\sqrt{x}}{\tan x} = \dfrac{x^{\frac{1}{2}}}{\tan x}$

$$y' = \frac{\frac{1}{2}x^{-\frac{1}{2}}(\tan x) - x^{\frac{1}{2}}\sec^2 x}{\tan^2 x}$$

$$= \frac{\frac{1}{2\sqrt{x}}\tan x - \sqrt{x}\sec^2 x}{\tan^2 x}$$

Find the derivative of 2 sec x cos x

$$= 2 \frac{1}{\cancel{\cos x}} \cdot \cancel{\cos x}$$

$$y = 2$$

$$y' = 0$$

Find the derivative of $x^2 + \sec x$

$$y' = 2x + \sec x \tan x$$

Find the derivative of

$$\frac{4}{x} - \frac{3}{x^2} + 4\cos x$$

$$y' = -\frac{4}{x^2} + \frac{6}{x^3} - 4\sin x$$

Find the derivative of $x^2 \sin x + \tan x \cos x$

$\frac{\sin x}{\cos x} \cdot \cos x$

$y' = 2x\sin x + x^2 \cos x + \cos x$

Find the derivative of $\frac{4}{x} + \sec x$

$$y' = \frac{-4}{x^2} + \sec x \tan x$$

Find the derivative of $\frac{\sqrt{x}}{4}$

Find the derivative of 2 csc x =

Find the derivative of $3x^3 - \frac{5}{x^2} + 6 \cot x$

Find y" if y = sec x

$$y' = \sec x \tan x$$

$$y'' = \sec x \tan x \tan x + \sec x \sec^2 x$$

$$= \sec x \tan^2 x + \sec^3 x$$